



Robust and Highly Efficient Wide-Input Range Power Converter for Space Application

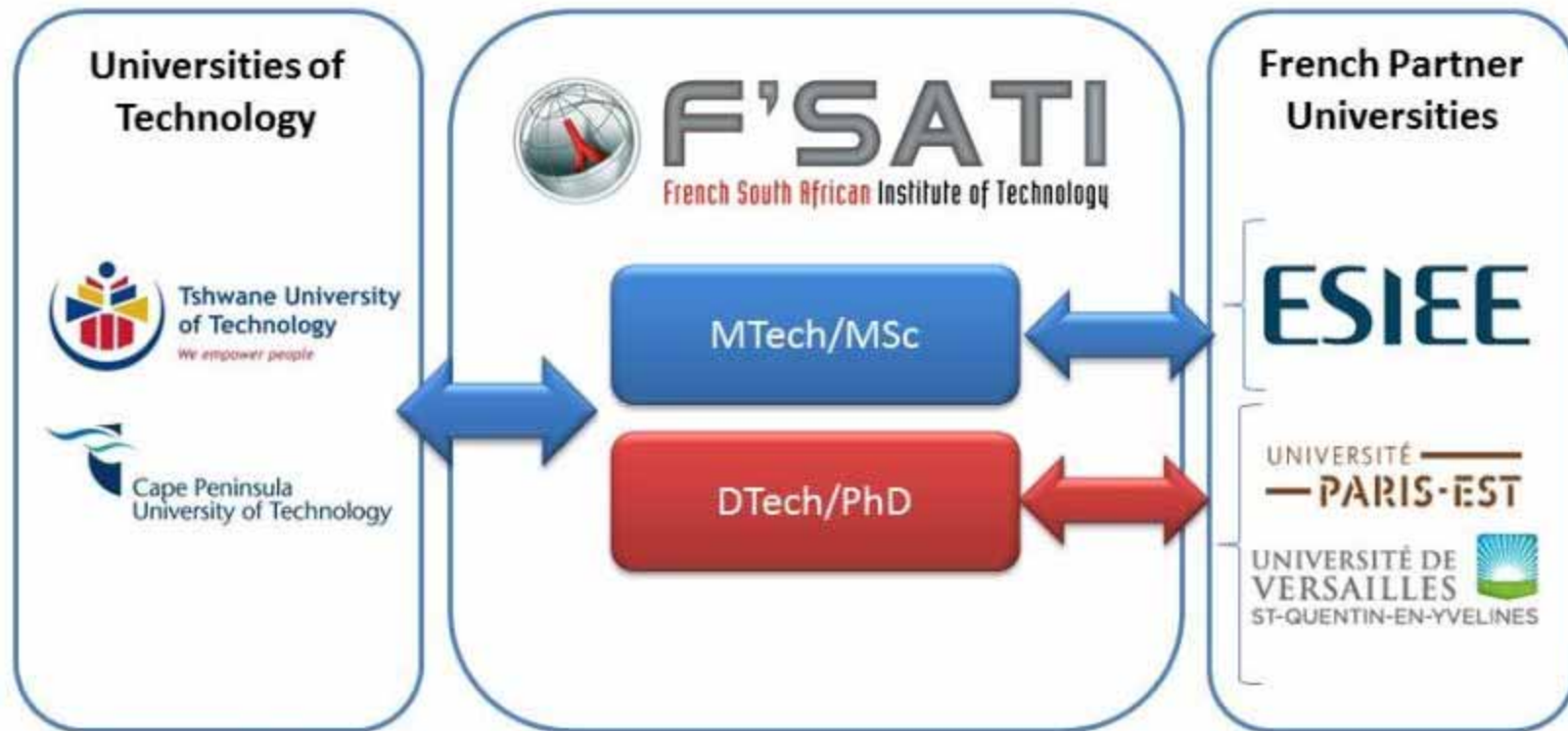
M.B. Khader, A. K. Raji, and M. Adonis



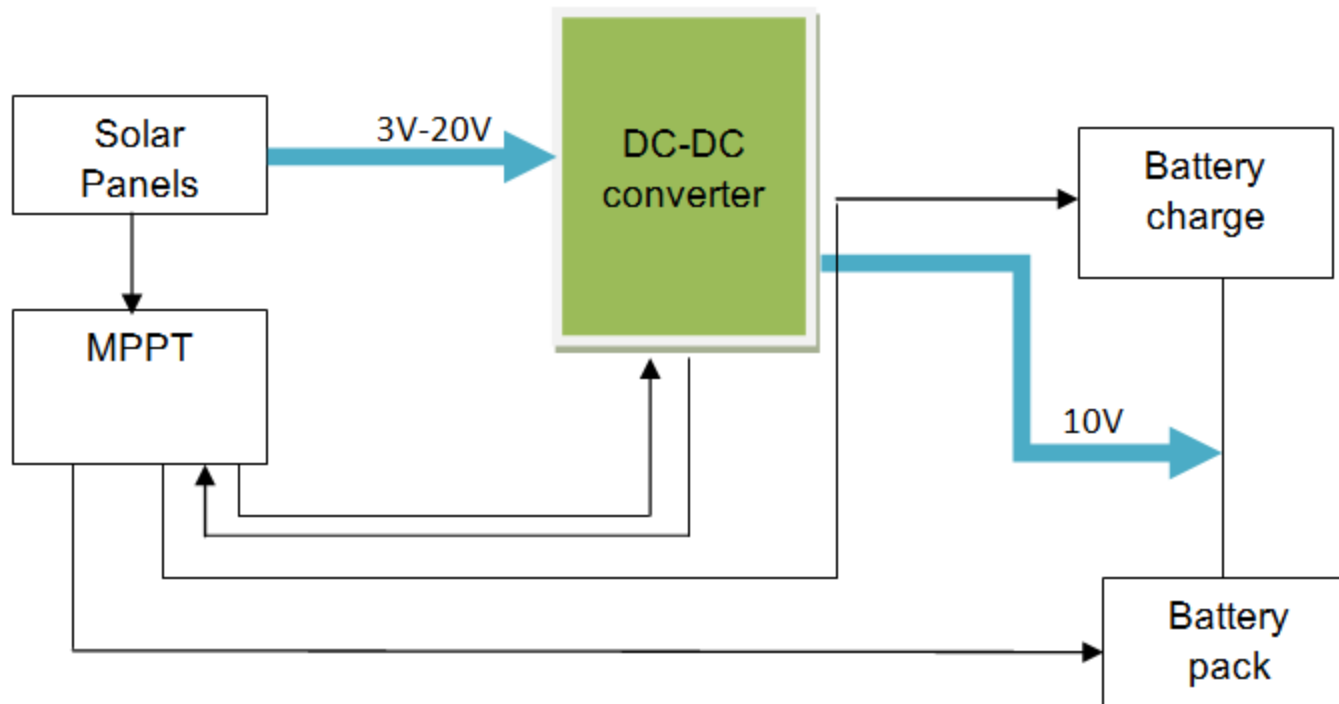
Contents

- Background and Introduction
- Design consideration and PI controller
- PSIM software package
- SEPIC converter
- PI Voltage mode control
- AC-Sweep and Compensation
- Results
- conclusion

Background and Introduction



Background and Introduction



Background and Introduction

DC-DC TOPOLOGY	LOSSES	EFFICIENCY	COMPLEXITY
Buck			
Boost			
Buck-Boost			
SEPIC			

Background and Introduction

DC-DC TOPOLOGY	LOSSES	EFFICIENCY	COMPLEXITY
Buck	High	Low	Low
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SEPIC			

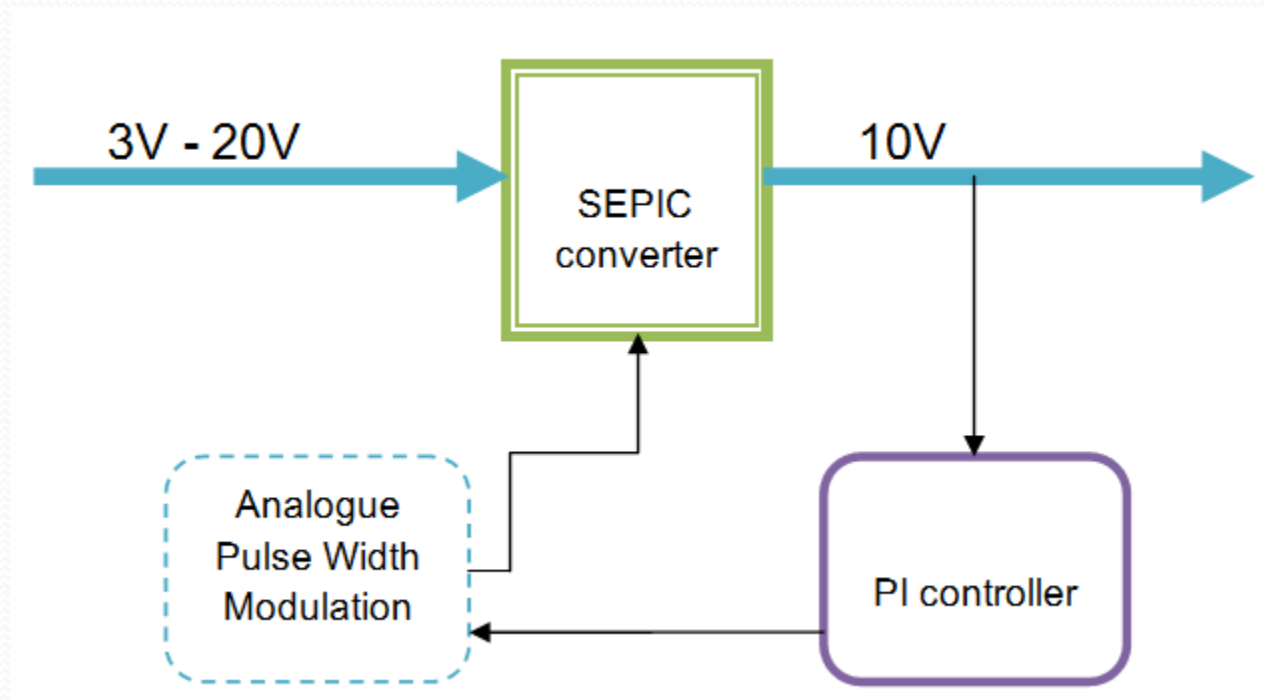
Background and Introduction

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Boost	High	Low	Low
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SEPIC	Low	High	Low

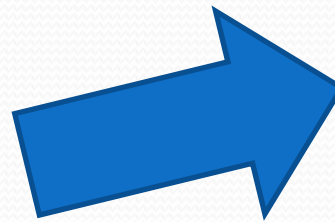
Design consideration and PI controller



PSIM software package

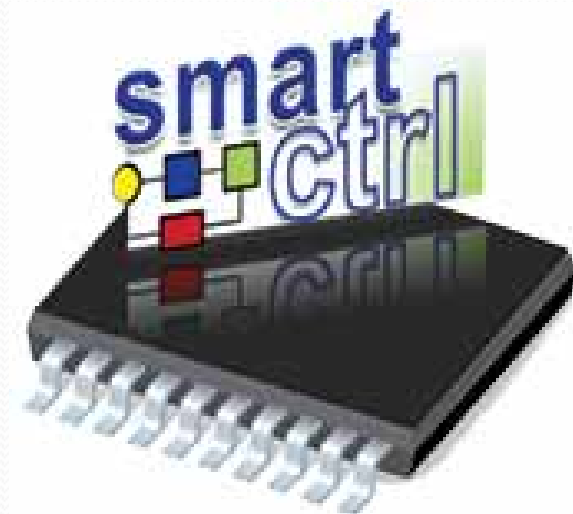
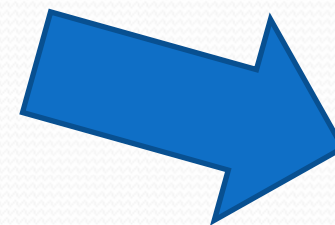
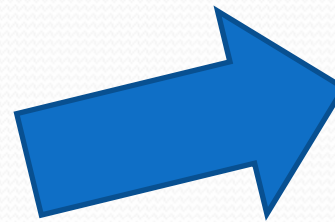


PSIM software package

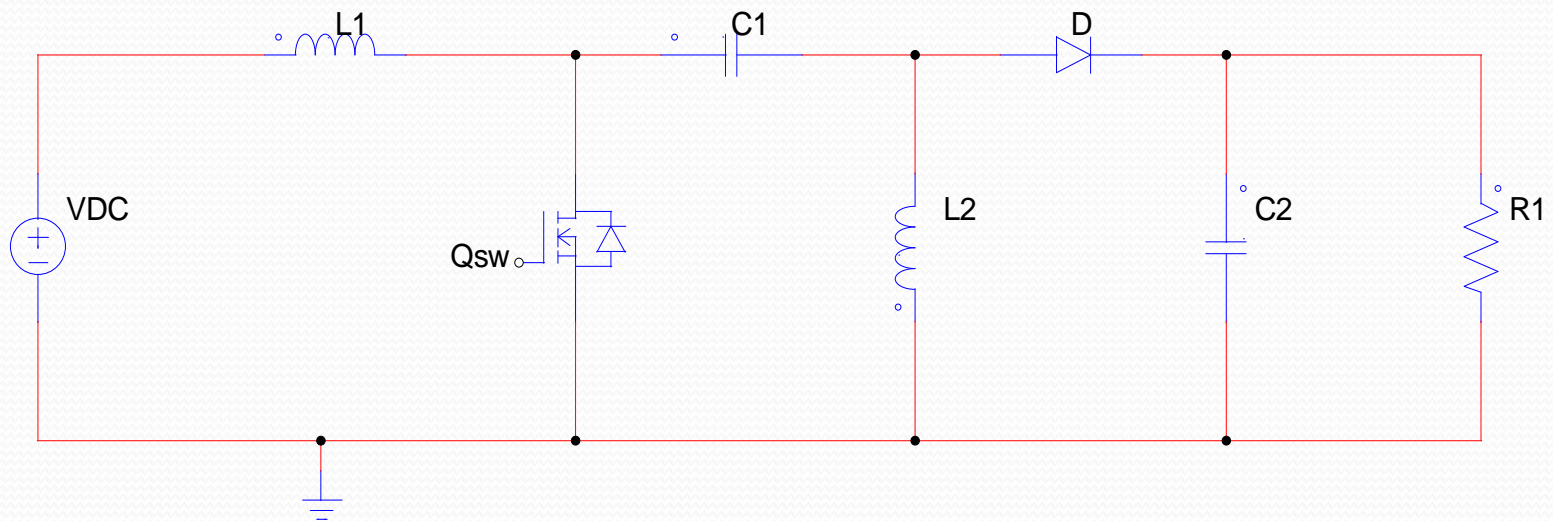


Schematics

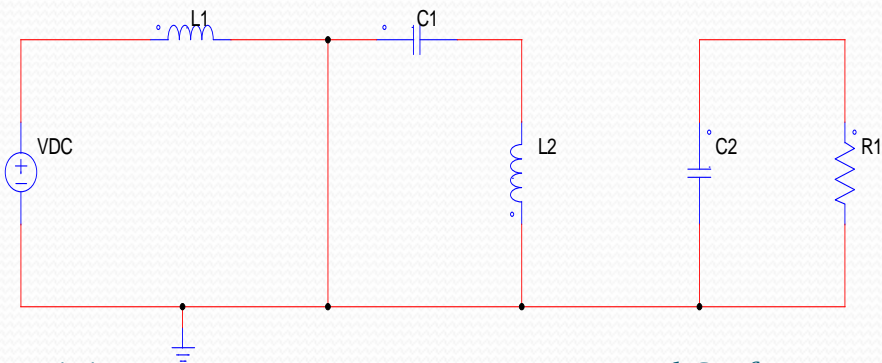
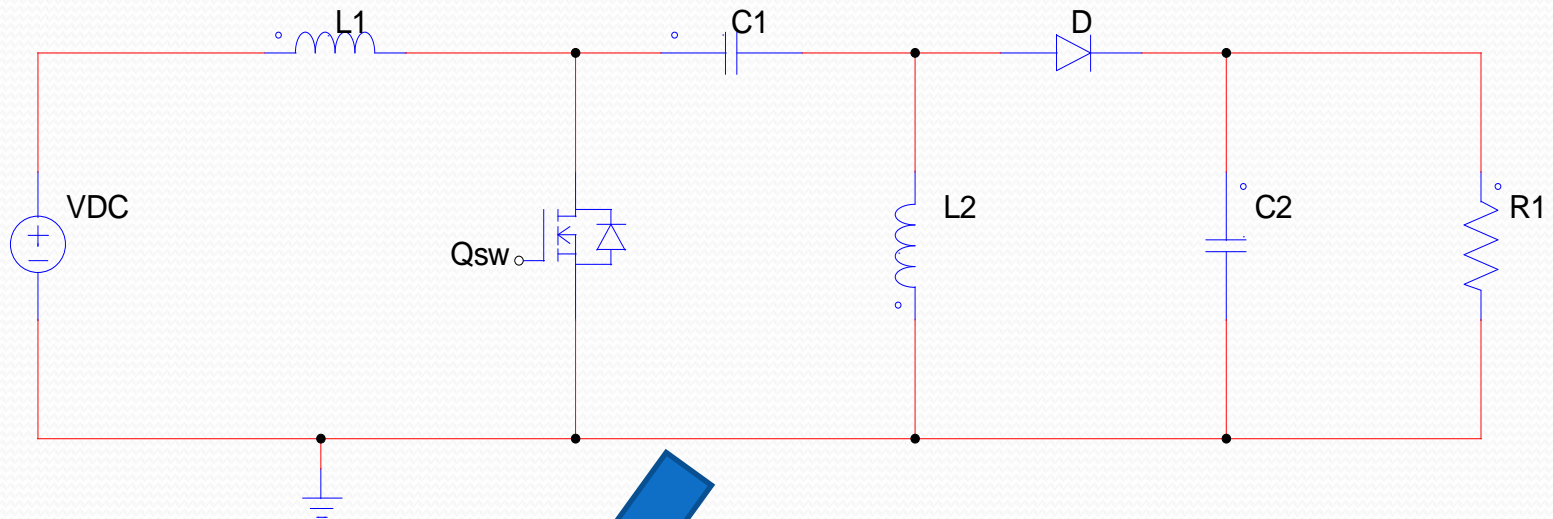
PSIM software package



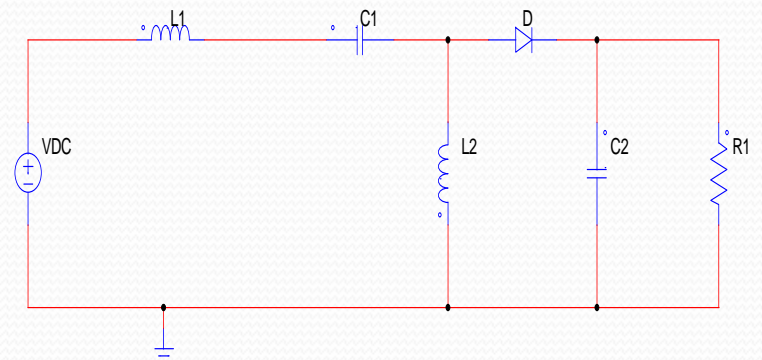
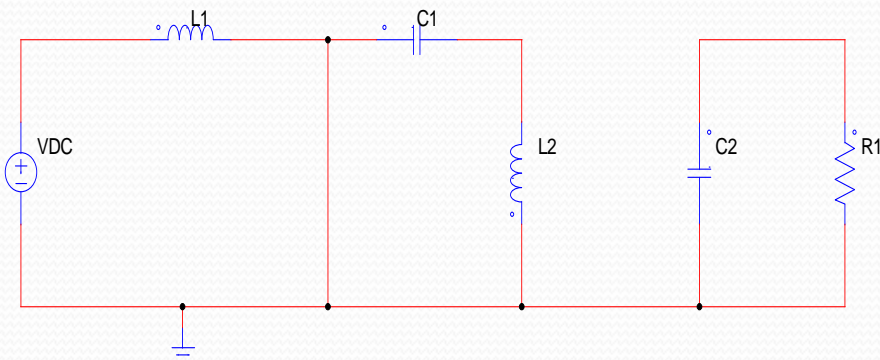
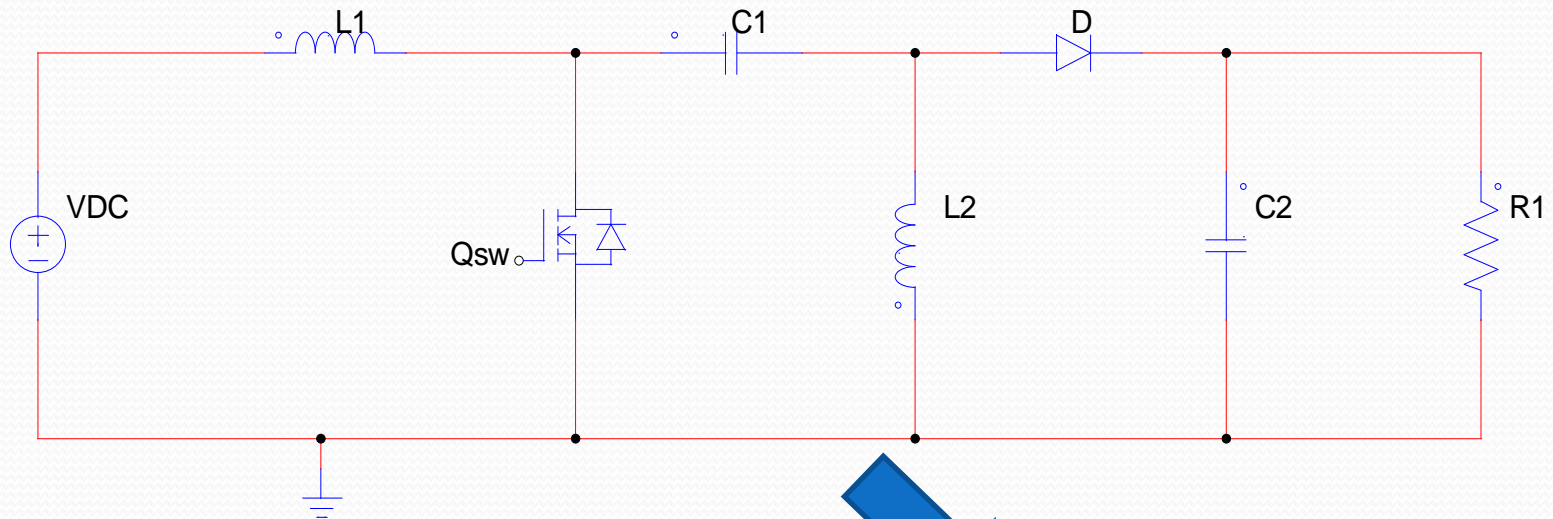
SEPIC converter



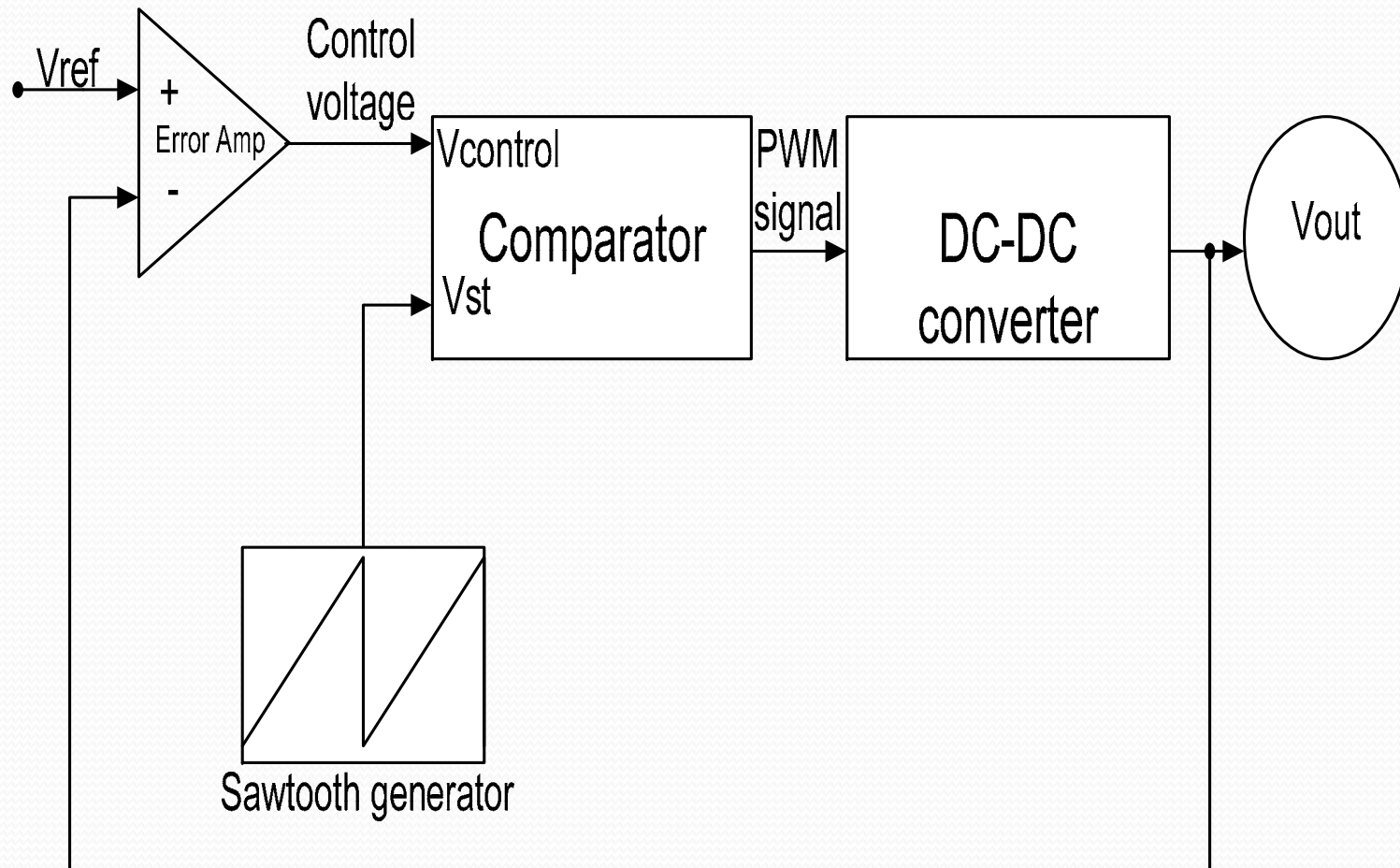
SEPIC converter



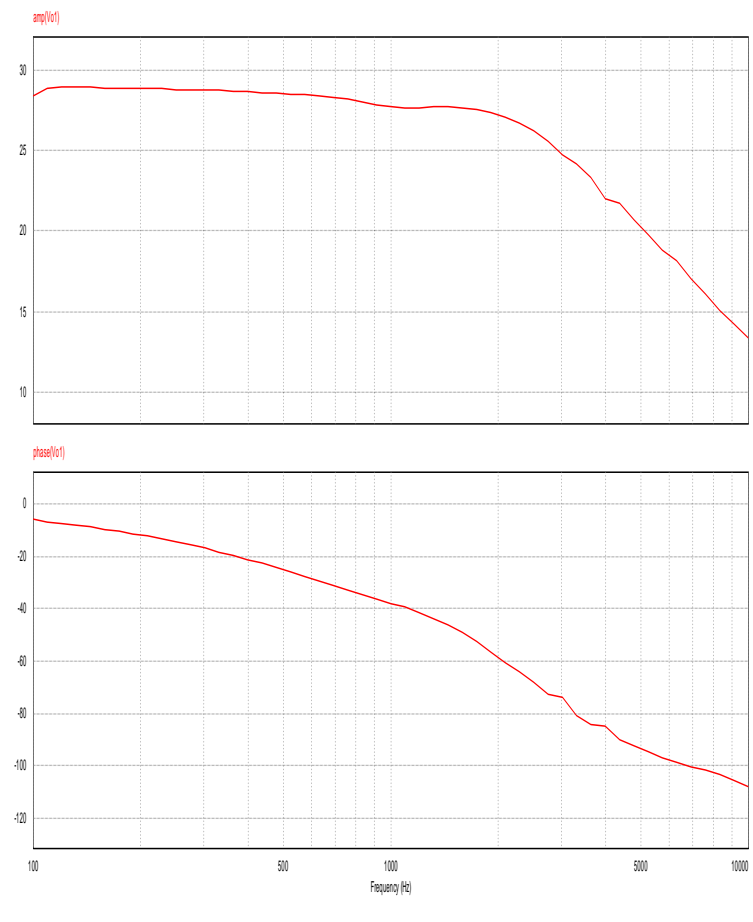
SEPIC converter



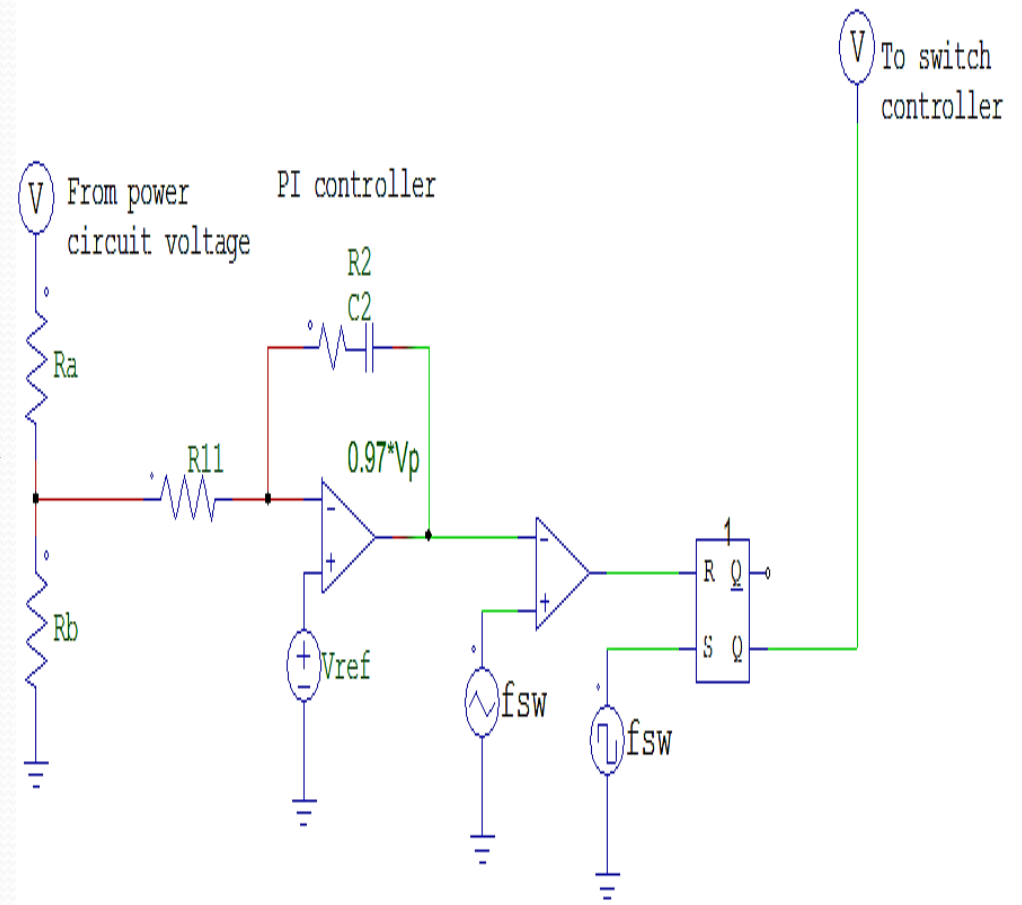
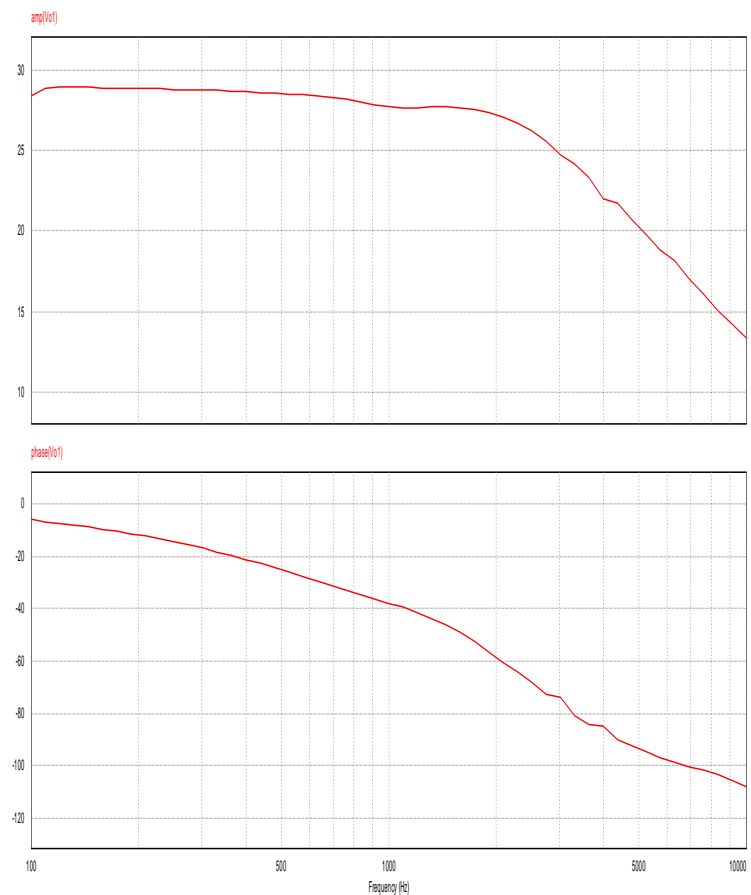
PI Voltage mode control



AC-Sweep and Compensation



AC-Sweep and Compensation

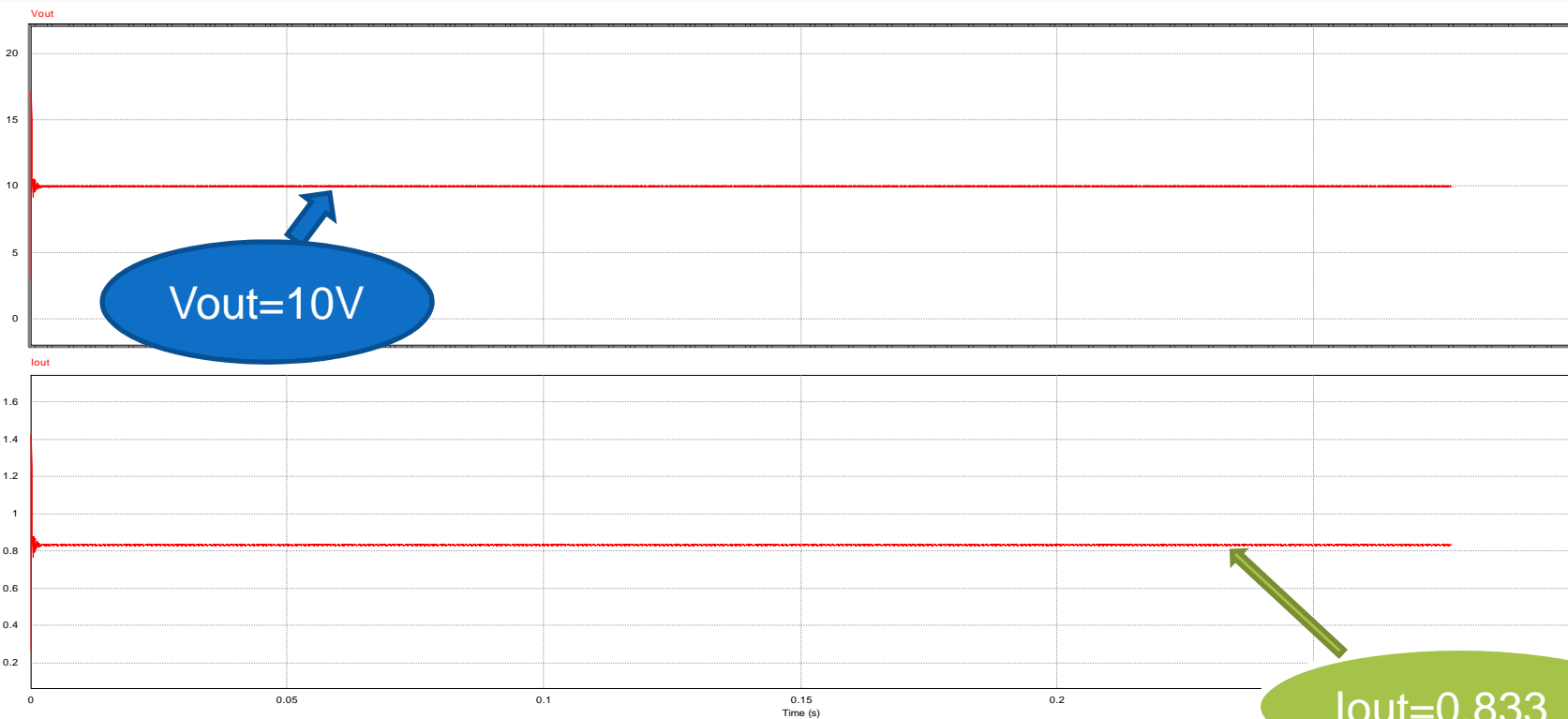


Results: SEPIC open-loop

•3V input voltage



10V output Voltage

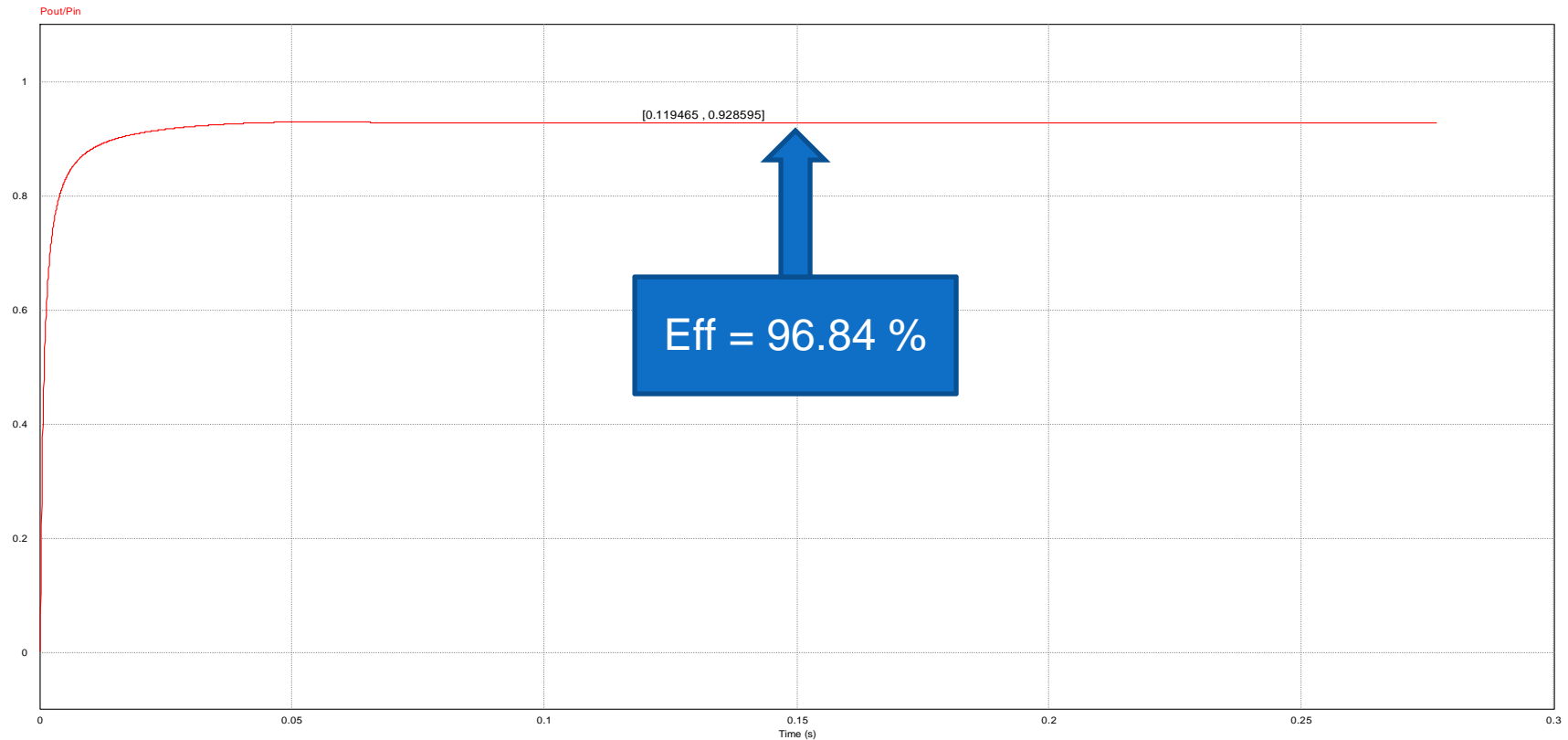


Results: SEPIC open-loop

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10V output Voltage

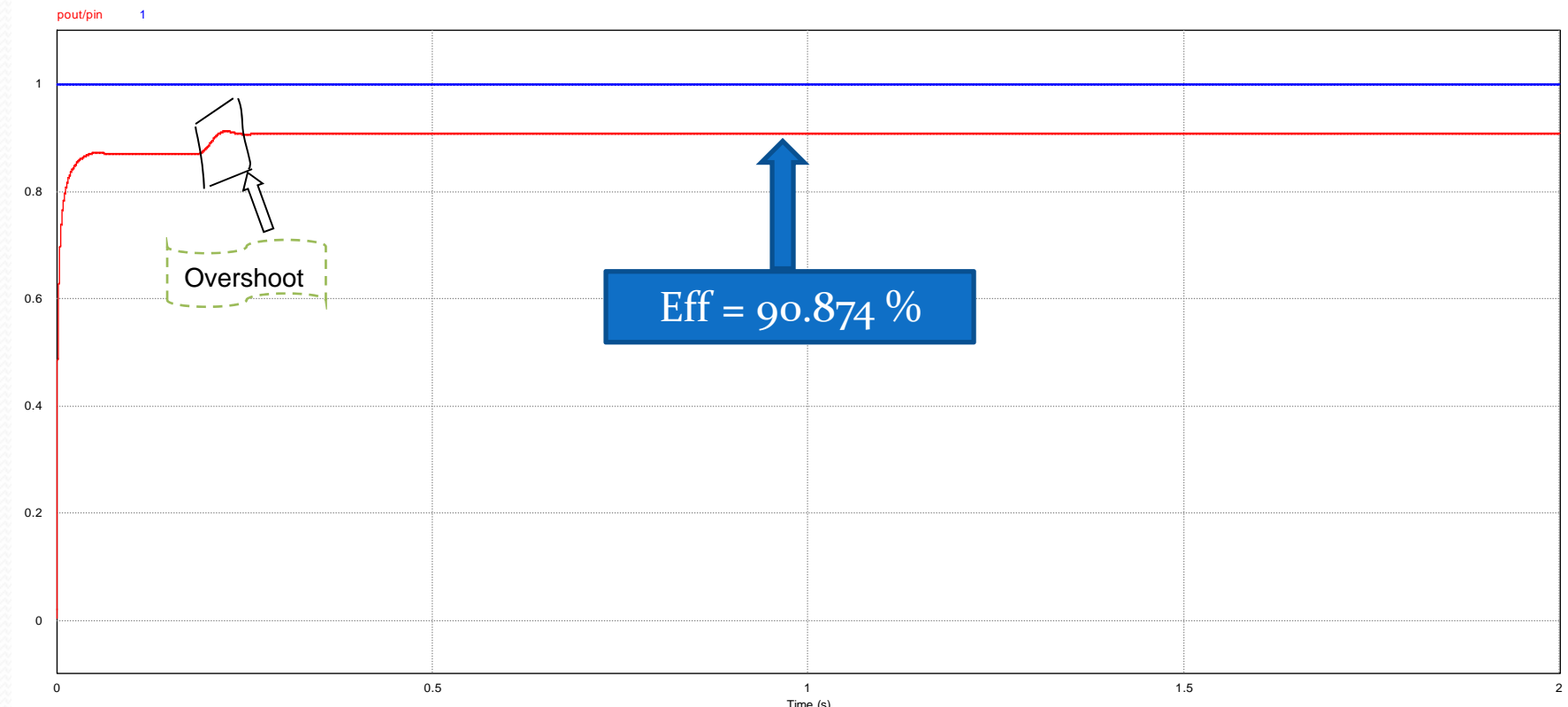


Results: SEPIC open-loop

•20V input voltage



10V output Voltage

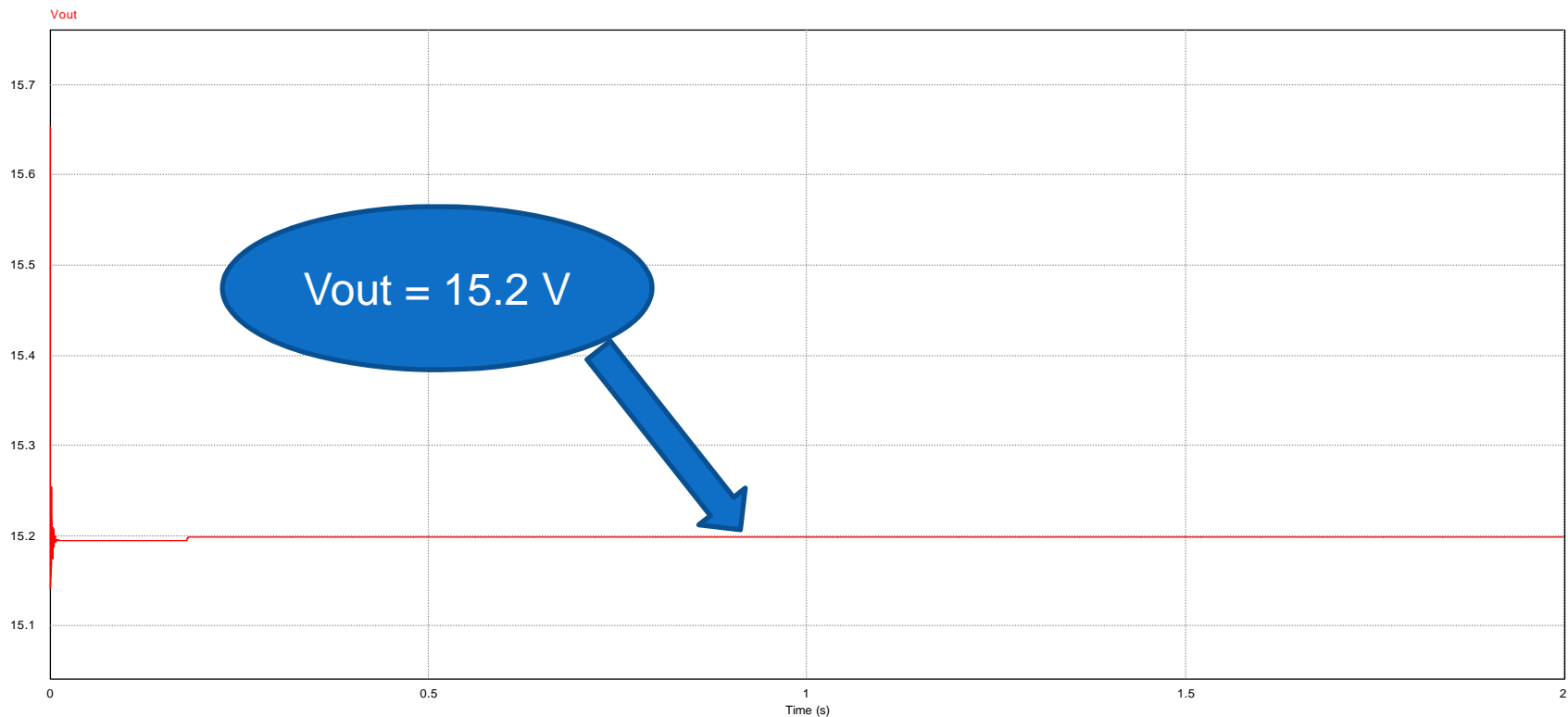


Results: SEPIC open-loop

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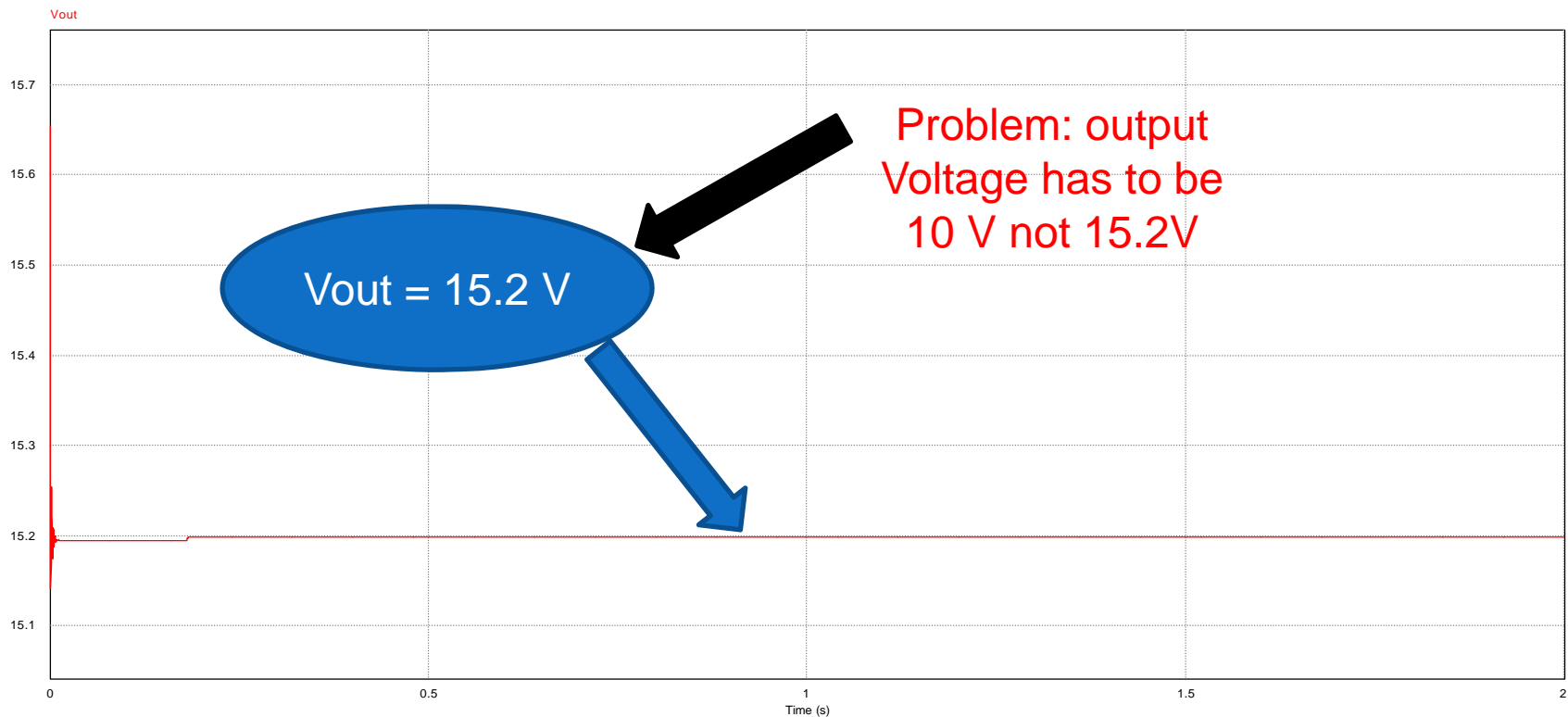


Results: SEPIC open-loop

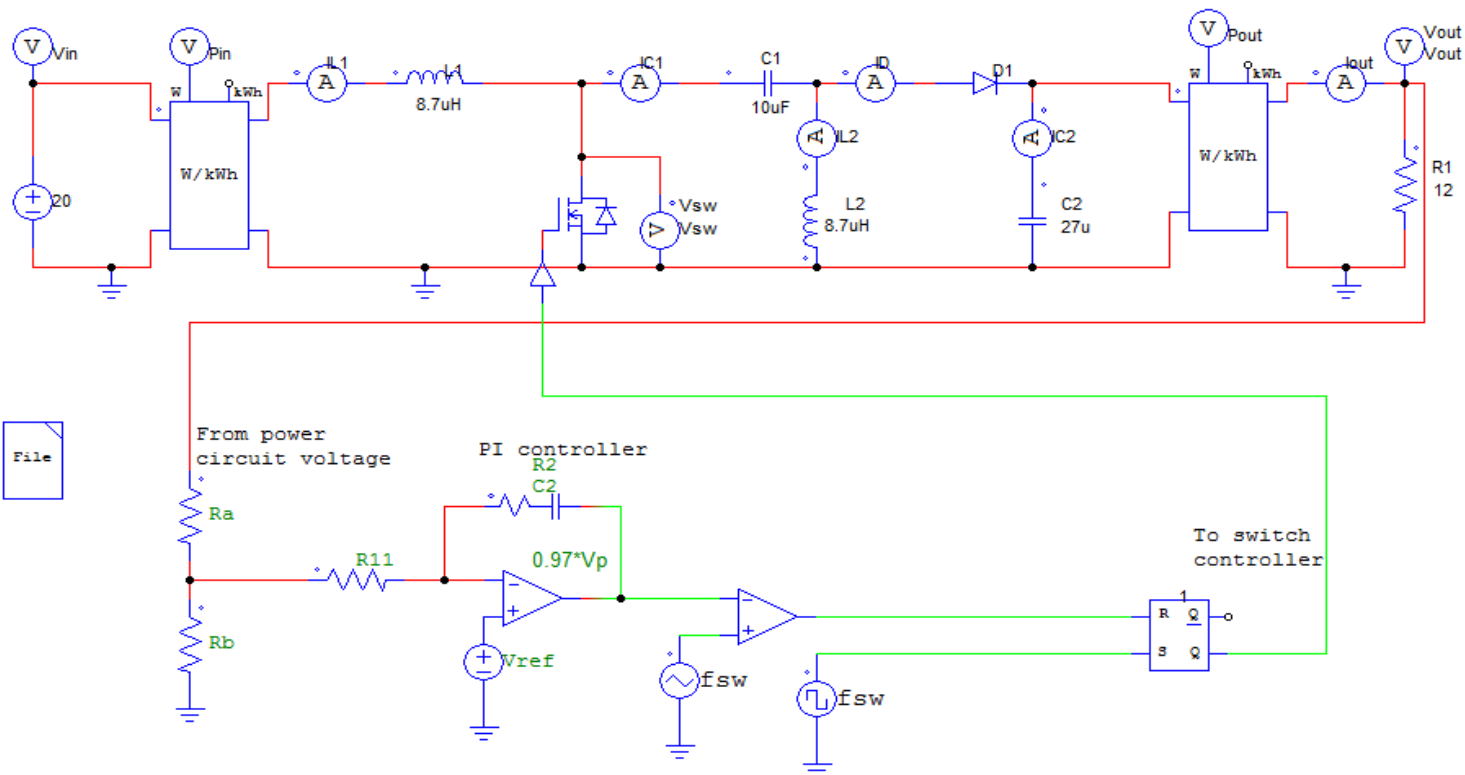
•20V input voltage



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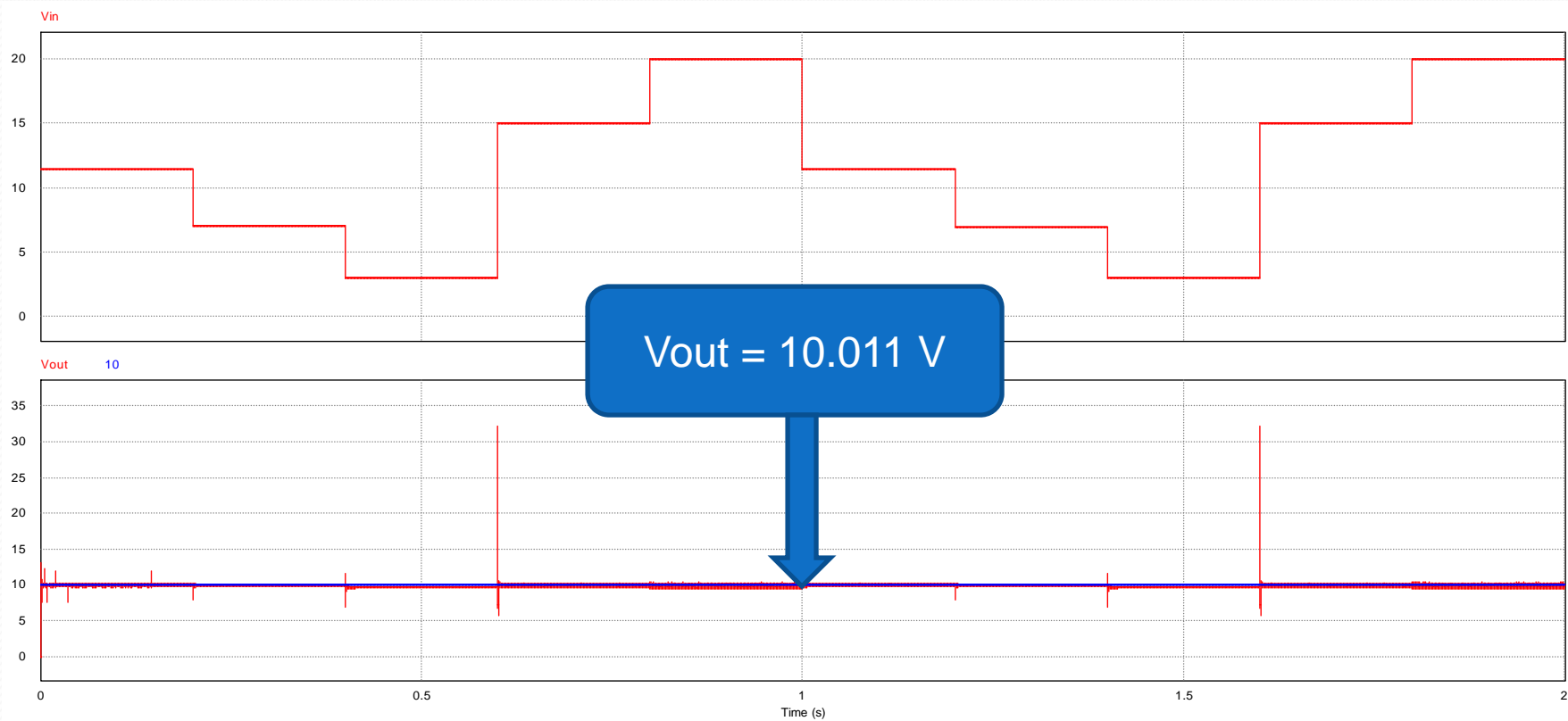
Results: SEPIC closed-loop



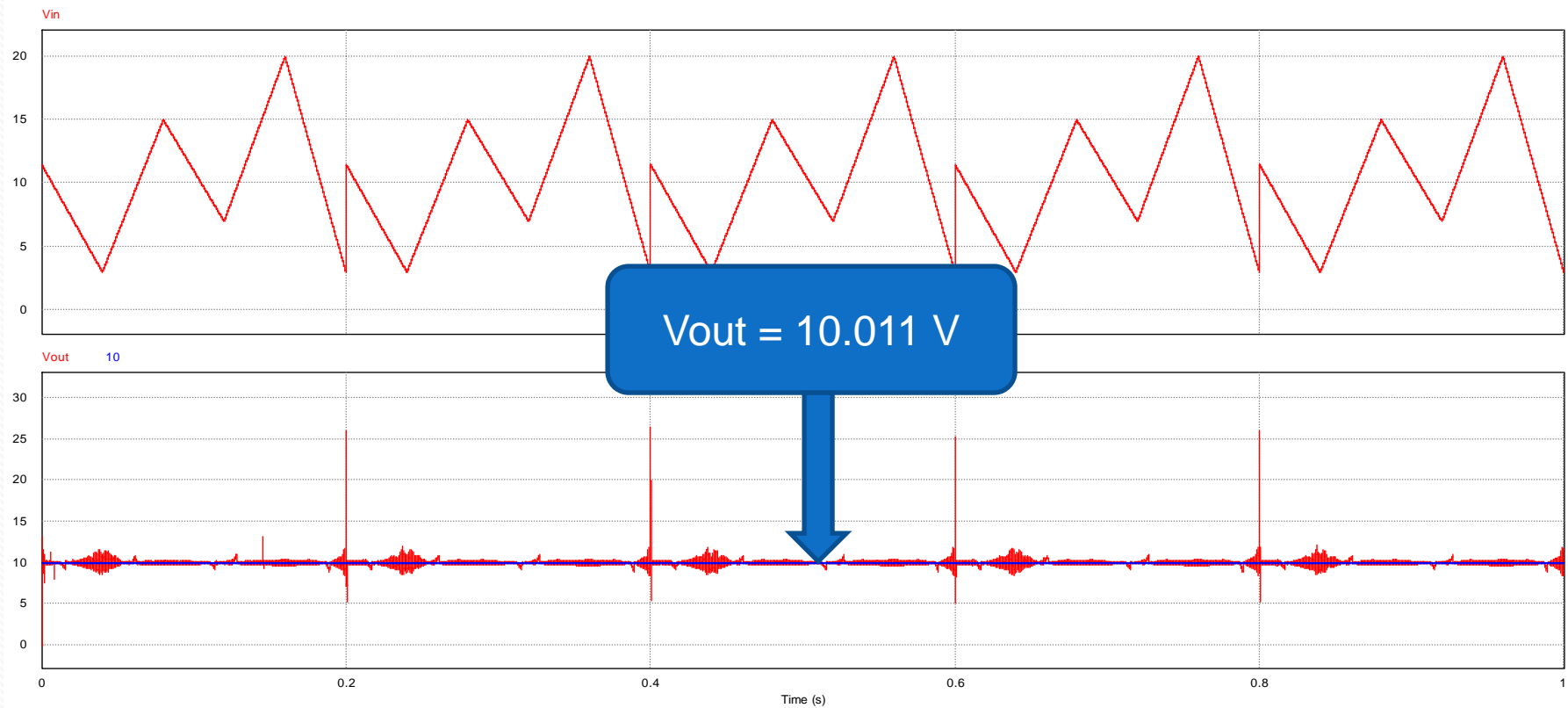
Results: SEPIC closed-loop data

Input data			Output data			Relations	
Voltage (V)	Current (A)	Power (W)	Voltage (V)	Current (A)	Power (W)	Eff (%)	Duty cycle (%)
3	2.205	8.177	9.759	0.815	7.884	96.368	76.51
5	0.997	8.559	10.035	0.838	8.189	95.677	66.77
7	0.292	8.401	10.027	0.838	8.178	97.346	58.92
9	0.128	8.534	10.019	0.837	8.180	95.852	52.71
11.5	0.217	8.348	10.015	0.837	8.180	97.988	46.58
13	0.226	8.367	10.021	0.837	8.181	97.777	43.56
16	0.236	8.378	10.016	0.837	8.354	99.713	38.53
19	0.225	8.315	10.011	0.836	8.182	98.401	34.54
20	0.216	8.279	10.011	0.836	8.183	98.840	33.39

Results: SEPIC closed-loop



Results: SEPIC closed-loop





Conclusion

- Performance of the PI voltage mode control
- High efficiency
- Stability of the output voltage



Thank you